

Fermi National Accelerator Laboratory LDRD Project Data Sheet - FY15

Project ID: FNAL-LDRD-2015-009

Project title: High Energy Physics Pattern Recognition with an Automata Processor

Principal investigator: Michael Wang

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

Develop a proof of concept demonstrating that an Automata Processor (AP) is ideally suited to fast high energy physics (HEP) pattern recognition applications and can provide an off-the-shelf alternative to demanding online applications traditionally addressed by custom hardware solutions. An AP algorithm will be developed for track pattern recognition problems based upon the Compact Muon Solenoid (CMS) pixel detector and Liquid Argon time projection chambers (LArTPCs) for future neutrino experiments.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Experiments at all the frontiers of high energy physics require efficient solutions to pattern recognition problems. The Automata Processor has promise to deliver superior performance for such problems and may enable new investigations at future experiments that would otherwise not be possible.

Previous year's accomplishments: (as applicable)

A software toy detector approximating the CMS phase-1 pixel detector has been developed with the ability to simulate events, have the particles tracked, and record generated pixel hits. An Automata Processor algorithm has been designed to represent unique track patterns. This algorithm and tools have been implemented in the AP emulator. The testing of the toy detector and AP algorithm has begun including adding additional details such as pile-up simulation. A poster has been submitted to a high-energy physics computing conference. Final details for obtaining the membership agreement and NDA with the University of Virginia and Micron are being completed.

Work proposed for current fiscal year and anticipated / desired results:

Development using the AP algorithm for CMS pixel track reconstruction will continue. The membership agreement and NDAs will allow for testing with the hardware AP once it is available. If this R&D is successful, a working implementation will be delivered and characterized for a LArTPC track-finder and pattern recognition for the LArTPC waveform in the second year of the project.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY15 through 8/15	FY16 budgeted	FY17 budgeted	Total
N/A	142099	224,311	0	366,410

Project Start Data: 2/1/2015 (est) Total Approved Project funds: \$ 443,960